

# Preventing Magnesium Toxicity in Obstetrics

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**PROBLEM:** Practitioners who work in obstetrical units may feel assured in administering intravenous (IV) magnesium sulfate for treating preterm labor and pre-eclampsia. Yet many errors, some fatal, have been reported with this medication. Most of these errors were a result of unfamiliarity with safe dosage ranges and signs of toxicity, inadequate patient monitoring, mistakes in programming the pump, and mix-ups between magnesium sulfate and oxytocin.

A detailed account of errors with magnesium sulfate has been published.<sup>1</sup> In the span of a few years, the authors, who have been involved in an ongoing review of obstetrical mishaps in the U.S., accumulated 52 reports of accidental overdoses of magnesium sulfate. Simpson and Knox described 12 cases in detail, revealing common precipitating events.<sup>1</sup> Following are a few scenarios from their article:

A nurse accidentally restarted an infusion of magnesium sulfate instead of beginning a new infusion of oxytocin after a mother had delivered her baby. Although the infusion had been administered during preterm labor, it remained connected at the patient's Y-site—despite the fact that the infusion had been discontinued and was no longer being given. The oxytocin solution was connected to the patient's IV line, but the magnesium sulfate solution was started by mistake. The mother was found unresponsive and has remained in a persistent vegetative state.

Before a patient was transferred to the postpartum unit, the nurse had accidentally replaced a mother's depleted Lactated Ringer's solution with an unlabeled liter bag of magnesium sulfate that had been prepared by another nurse for a different patient. Because the mother had pre-

eclampsia, a magnesium sulfate solution was already being infused when the second solution was hung. After the patient was taken to the busy, understaffed postpartum unit, she was later found in respiratory arrest and developed anoxic encephalopathy.

A nurse prepared a bag of magnesium sulfate (40 g/L) and began an infusion at 200 mL/hour to deliver a 4-g bolus dose (100 mL) over 30 minutes. After remaining with the patient for 20 minutes, the nurse was suddenly called away. She returned 25 minutes later to find that the patient had received a 6-g loading dose. The patient was flushed and nauseated, had shallow respirations, and was unable to move her extremities. Concerned about toxicity, the physician ordered a test of the solution, which revealed a concentration of 80 g/L. The nurse had misread the vial labels and had added too much magnesium sulfate to the IV bag. The patient had actually received a 12-g loading dose; fortunately, she recovered without permanent harm.

A nurse retrieved two bags of Lactated Ringer's solution from stock and added 40 g of magnesium sulfate to one bag. After administering a 6-g bolus dose, she started the infusion at 3 g/hour and hung a maintenance solution of Lactated Ringer's solution at 300 mL/hour. Several hours later, the patient reported feeling flushed and nauseated. The nurse told her that these symptoms were to be expected. After a short time, the nurse observed the patient sleeping. Later, family members found the patient not breathing and without a pulse. Resuscitation efforts were unsuccessful. An analysis revealed that the maintenance solution (300 mL/hour) contained 40 g of magnesium sulfate and the bag labeled as magnesium sulfate contained only Lactated Ringer's solution. The admixture label had been placed on the wrong bag of Lactated Ringer's solution.

**SAFE PRACTICE RECOMMENDATIONS:** In the article, Simpson and Knox noted that patient transfers to units with lower staffing levels, chaotic environments, and

changeable nursing assignments were the most common factors among several errors that resulted in death. To reduce the risk of harm when giving magnesium sulfate to obstetrical patients, all health care professionals should consider the following:

**1. Premixed solutions.** Nurses should not have to mix magnesium sulfate solutions. Instead, a standard concentration of commercially available premixed solutions for bolus doses and maintenance infusions should be available. Simpson and Knox also suggest using 20-g/500-mL premixed solutions (not 40 g/L) to reduce injury in the event of a free-flow incident. Nonstandard concentrations should be avoided. Bolus doses should be given in separate, premixed piggyback infusions; they should not be administered from the maintenance infusion.

**2. Label lines.** The IV tubing should be labeled near the IV pump. When infusions are started or when the rate is adjusted, the tubing should be traced by hand from the IV bag, to the pump, and then to the patient for verification.

**3. Protocols.** Dosing and administration protocols and standard order sets for magnesium sulfate should be established. Simpson and Knox also suggest standardizing the unit of measure used to prescribe magnesium sulfate (grams, mEq) and reporting laboratory values (mg/dL, mEq/L, mmol/L). An infusion pump, preferably a "smart pump" with operational dose range alerts, is preferred. If the drug is discontinued, the infusion bag and tubing should be removed immediately from the patient's access site, pump, and IV pole to prevent later accidental infusion. The bag should be properly disposed of.

**4. Double checks.** An independent double check of the drug, concentration, infusion rate, pump settings, line attachment, and patient should be required before IV magnesium sulfate is administered. Point-of-care bar-code systems can also be used to verify the drug, strength, and patient. When transferring

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patients, the receiving nurse and the transferring nurse should verify the drug, concentration, line attachment, and pump settings at the bedside by comparing these against the original order.

5. **Monitoring.** The patient's vital signs, oxygen saturation, deep tendon reflexes, and level of consciousness should be monitored. Monitoring of fetal heart rate and maternal uterine activity is also essential if the drug is used for preterm labor. The patient should be assessed for signs of toxicity (e.g., visual changes, somnolence, flushing, muscle paralysis, loss of patellar reflexes) or pulmonary edema. If these signs are observed, a physician must be notified. During bolus administration, a staff member should remain at the patient's bedside to oversee continuous monitoring. Subsequent assessment intervals of 15 minutes are suggested for the first hour, 30 minutes for the second hour, and then hourly.

6. **Assessing toxicity.** If there is a concern about toxicity, laboratory testing might be needed. However, Simpson and Knox caution that toxic levels can vary among patients. Thus, a clinical assessment is as important as a determination of serum magnesium levels. Patients and their caregivers should be instructed on signs of toxicity to report.

7. **Staffing ratios.** Staffing patterns should be sufficient to allow time for proper monitoring on antepartum and postpartum units.

8. **Emergency preparedness.** Standard procedures should be established for staff members to respond to emergencies caused by overdoses. Stocking calcium gluconate on the unit is suggested, with directions for use in patients with respiratory depression.

### REFERENCE

1. Simpson KR, Knox GE. Obstetrical accidents involving IV magnesium sulfate. *Am J Maternal Child Nurs* 2004;29:161-171.

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*The reports described in this column were received through the ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP Web site ([www.ismp.org](http://www.ismp.org)) or communicated directly to ISMP by calling 1-800-FAIL-SAFE or via e-mail at [ismpinfo@ismp.org](mailto:ismpinfo@ismp.org). ■*